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## (54) Engine control system for controlling in-cylinder fuel injection engine

In order to provide a system that lower NOx emission and an improved fuel consumption are obtained by making the igniting control possible in the wide operation range by performing the fuel injection and the ultra lean burning with the homogeneous air-fuel mixture, in the engine (13) having the compression igniting mode, in the in-cylinder fuel injection engine having the compression igniting mode, means for performing the first fuel injection for the initial combustion speed control before igniting and the second fuel injection for the engine torque control after that, are provided. The second fuel injection ratio for the engine torque control is increased according to the engine torque. Furthermore, in order to improve the igniting, the igniting trigger means is provided in the in-cylinder fuel injection engine (13) having a compression igniting mode and the igniting trigger is added by the igniting trigger means after the first fuel injection.

FIG. 1



#### **EUROPEAN SEARCH REPORT**

Application Number EP 00 10 9121

Category	Citation of document with i	ndication, where appropriate.	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.CI.7)	
Х	EP 0 886 050 A (TO) 23 December 1998 (1 * column 9, line 48 * column 11, line 6 * column 11, line 6	1-3	F02P5/04 F02D41/30 F02D37/02 F02D41/40 F01L9/00		
X Y	US 5 027 764 A (REI 2 July 1991 (1991-0 * abstract * * column 1, line 11 * column 1, line 31 * column 2, line 48	77-02) line 27 * line 42 * 3 - line 56 *	13,15,16 5-8,11, 12,18,19		
X Y	* claims; figures * DE 195 19 663 A (DA 15 May 1996 (1996-0 * column 3, line 46 * claims; figures *	AIMLER BENZ AG) 15-15) 5 - column 5, line 15 *	1,3,13, 14 5-8,11, 12,17	TOURNOUS FIELDS	
Y	() 26 February 1998 * page 10, line 1 - * page 21, line 3 - * page 25, line 4 - * page 35, line 10 * page 38, line 15 * page 40, line 8 - * page 54, line 18 * page 62, line 23	INC (US); HUNTER GARY L (1998-02-26) page 12, line 22 * line 21 * line 17 * - page 36, line 23 * - page 39, line 13 * page 41, line 9 * - page 55, line 8 * - page 66, line 17 * -/	17-19	TECHNICAL FIELDS SEARCHED (Int.Cl.7) F02D F01L F02B	
	The present search report has	been drawn up for all claims  Date of completion of the search		Examiner	
	Place of search THE HAGUE	13 September 2002	. Libe	eaut, L	
X : parti Y : parti docu A : tech O : non-	ATEGORY OF CITED DOCUMENTS icularly relevant if taken alone cularly relevant if combined with anotiment of the same category nological background -written disclosure mediate document	T : theory or principle E : earlier patent doc after the filing dat her D : document cited in L : document cited to	underlying the interest in the application of other reasons	nvention shed on, or	



# **EUROPEAN SEARCH REPORT**

Application Number EP 00 10 9121

<del></del>		PERED TO BE RELEVANT	Т -		
Category	Citation of document with of relevant pas	ndication, where appropriate, sages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Ct.7)	
A	GEMISCHANSAUGENDEN SELBSTZUENDUNG" MTZ MOTORTECHNISCHE FRANCKH'SCHE VERLAG TECHNIK. STUTTGART, vol. 53, no. 2,	SHANDLUNG,ABTEILUNG DE, 192-02-01), pages 80-85,	1-20		
۱٠	GB 2 327 980 A (FOR 10 February 1999 (1 * the whole documen	999-02-10)	1-20		
				TECHNICAL FIELDS SEARCHED (Int.CI.7)	
			·		
	The present search report has b	een drawn யுற for all claims			
	Place of search	Date of completion of the search		Examiner	
	THE HAGUE	13 September 2002	Libe	aut, L	
X : partici Y : partici docum A : lechno O : non-v	TEGORY OF CITED DOCUMENTS  Jarly relevant if taken alone larly relevant if combined with anoth ent of the same category biogical background written disclosure editate document	E : earlier patent doct after the fitting date er D : document cited for L : document cited for å : member of the sar	T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filling date D: document cited in the application L: document cited for other reasons  &: member of the same patent family, corresponding document		

E-O FORM 1503 03.82 (P04C01)

### ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 00 10 9121

This annex lists the patent family members relating to the patent documents cited in the above—mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

13-09-2002

Patent document cited in search report		Publication date		Patent family member(s)		Publication date	
FP .	0886050	A	23-12-1998	JP	11072038	Α	16-03-1999
<u>.</u> ,	0000000		<b>20</b> 12 11 1	EP	0886050	A2	23-12-1998
				US	6182632	B1	06-02-2001
US !	5027764	Α	02-07-1991	NONE			
DE	19519663	Α	15-05-1996	DE	19519663	A1	15-05-1996
un -	9807973	A	26-02-1998	AU	4082997	Α	26-03-1998
	300,7,0	• •		AU	4158097	Α	06-03-1998
				CN	1233313	Α	27-10-1999
				EΡ	0928369	A1	14-07-1999
				JP	2000514526	T	31-10-2000
				WO	9810179	A2	12-03-1998
				WO	9807973	A1	26-02-1998
				US	2001017127	A1	30-08-2001
				US	6286482		11-09-2001
				US	2002026926	A1 	07-03-2002
GB	2327980	A	10-02-1999	DE	69805076	D1	29-05-2002
	202.70			DE	69805076	T2	29-08-2002
				ΕP	1000231	A1	17-05-2000
				WO	<b>99066</b> 83	A1	11-02-1999
				JP	2001512208	T	21-08-2001
				US	6227151	B1	08-05-2001

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82